

plants stayed highly limited. Efforts to add new species with allelopathic effect or residual effect and to extent the range of effected plants have been continued mainly in controlled conditions. These studies included tree parts as well as herbs. Several species were suggested to use weed control in corn. Allelopathic chemicals such as juglon and dopa investigated for their effect on plants in addition to water or oil extracts of plants and plant residues. Alfalfa has been suggested as an allelopathic crop to control some weeds such as *Acroptilon repens* and *Artemisia vulgaris*. In vitro experiments were carried out to find out the possible crops that can succeed alfalfa without any chemical site effect of alfalfa. The allelopathic relations between *Artemisia vulgaris* and alfalfa were studied. The aim of studies is not only controlling weeds in crops but also understanding weed interference. Although experts who attended the National allelopathy workshop agreed on collaboration and a national network, no visible attempt has been made. However, allelopathy studies have been going on.

381. Phytotoxic Mechanisms of L-DOPA and M-Tyrosine. Hiroshi Matsumoto¹, Mayumi Hachinohe¹; ¹University of Tsukuba, Tsukuba, Ibaraki, Japan

L-DOPA (3,4-dihydroxyphenylalanine) is one of well-known allelochemicals that inhibits plant growth. In the survey of phytotoxicity among structurally related compounds with L-DOPA, we found that m-tyrosine has comparable phytotoxic potential with L-DOPA (Shirato et al., 2005). m-Tyrosine was also identified as the major component of phytotoxicity in fine fescue grasses (Bertin et al., 2007).

L-DOPA and m-tyrosine (10⁻⁴ M) inhibited the growth of lettuce root to 20% of non-treated control at 5 DAT. However, m-tyrosine did not show selectivity between lettuce and barnyardgrass that was observed in L-DOPA treatment. Our previous study showed that L-DOPA increased reactive oxygen species generated from the metabolic pathway from L-DOPA to melanin. Huge accumulation of melanin and typical oxidative damage were observed in L-DOPA -treated lettuce. m-Tyrosine also increased lipid peroxide formation in lettuce, but increase of melanin formation was less than that by L-DOPA. Exogenously-applied antioxidants, ascorbic acid and α -tocopherol, alleviated the phytotoxicity of L-DOPA but did not that of m-tyrosine. However, phenylalanine alleviated the phytotoxicity of m-tyrosine in roots of lettuce and rice. In a proteomics analysis, phenylalanine ammonia-lyase (PAL) was identified as one of responsive proteins in m-tyrosine treated rice. The amount of PAL expression decreased in m-tyrosine treatment, but did not decrease in m-tyrosine plus phenylalanine treatment.

These results suggest that phytotoxic action and mechanism are different between m-tyrosine and L-

DOPA. The decrease of PAL expression might be involved in the phytotoxic mechanism of m-tyrosine.

382. Effect of Aqueous Extract from *Flaveria bidentis* on Plant Germination. Xiangju Li¹, Miru Zhang¹, Yongjun Li¹; ¹Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing, China (Peoples Republic of)

Flaveria bidentis is an invasive plant recently found in north China. In order to investigate the invasive mechanism which is very important to the spread and ecological renovation of invasive plants, experiments were conducted in Petri dishes under laboratory conditions to study the effect of aqueous extracts of *F. bidentis* on plant germination and radical elongation. Among the 30 selected receiver plants, 29 species were inhibited in seed germination and 28 species were inhibited in radical length to varying degree in the extracts of *F. bidentis* at the concentration of 0.1g dry weight/mL, however, 2 species were stimulated in radical length in the extracts. There was a strong correlation between extract concentration and increased inhibition in test species. A gradually decrease of seed germination and radical length of *E. crus-galli* and *B. napus* was observed with increasing the concentration of the extracts. Radical length of *B. napus* was inhibited by 15.39% to 89.74% when extract concentration was 0.01 to 0.08g dry weight/mL and no germinated seed of *B. napus* was observed when extract concentration was 0.10g dry weight/mL. Seed germination and radical length of *E. crus-galli* and *B. napus* were inhibited more by extracts from mature plants than that from young plants of *F. bidentis* and more by extracts from leaves than that from stems, and roots was the last. These results indicated that *F. bidentis* may affect the germination and early growth of plants growing in the same ecosystem by releasing allelochemicals and the substances may accumulate and reduce the biodiversity in the invaded land if *F. bidentis* grows in high density.

383. Identification of Allelopathic Compounds from *Helianthus tuberosus* L. Leaves. Franco Tesio¹, Leslie Weston², Francesco Vidotto¹, Aldo Ferrero¹; ¹Università di Torino, Grugliasco, Torino, Italy; ²Environmentals, L.L.C. Consulting for the Landscape, Turf, and Ornamentals Industries, Ithaca, NY, United States of America

Allelopathy has been largely studied for several Compositae species, and a significant amount of information is available in particular on *Helianthus annuus* L.. Only a few studies, however, have considered the related perennial species *H. tuberosus* L. which is cultivated in Europe as vegetable and for industrial uses, and behaving as a weed in summer annual crops. The objectives of this study were to assess the allelopathic effects of different populations of *H. tuberosus* on germination and seedling growth of some

cultivated and weed species and to identify the allelochemicals responsible for the inhibitory activity. The release of the allelopathic compounds during the natural degradation of residues was simulated with a bioassay using Parker plates, filled with 150 g of soil and sand mixture, and different amounts of *H. tuberosus* dry leaf tissue (0.5, 1 and 1.5 g per plate). *H. tuberosus* rough material came from 4 cultivars (Fuseau, Red Fuseau, Stampede, Hybrid Stampede) and a weedy biotype (Italian). Inhibition of dry tissue was assessed in terms of seed germination, and shoot and root elongation of *Digitaria sanguinalis*, *Echinochloa crus-galli*, *Lactuca sativa*, and *Lycopersicon esculentum*. Fuseau resulted the most toxic cultivar on germination and growth of *D. sanguinalis*, showing an important inhibitory effect already at the lowest rate (0.5 g). None of the cultivars tested significantly inhibited the germination of *E. crus-galli*, even though root elongation was strongly affected at 1.5 g by almost all cultivars. Both shoot and root length of *L. sativa* was strongly affected by all cultivars. Root growth, in particular, was reduced for more than 78% at 1.5 g. On average, *L. esculentum* resulted the most sensitive indicator species, as no germination was observed, starting from the smallest amount of residues. Among the tested populations, the strongest inhibition activity, was recorded in the cultivars Fuseau and Stampede and in the biotype Italian. Powdered leaf tissues of these populations were used for the solvent extraction, with either hexane, ethyl ether, or ethyl acetate. Toxicity of the extracts on germination and shoot and root elongation of *L. sativa* was assessed in Petri dishes (5 cm). Ethyl ether fraction from the cultivar Fuseau was, on average, the most toxic. About 90% of shoot length reduction was achievable with only 0.21 µg/dish of extract. This fraction was analyzed with liquid-mass chromatography by detecting phenolic compounds. Salicylic acid was detected in all fractions tested at an average concentration of 10.16 mg/kg. Few amounts of o coumarinic and p coumarinic acids were also found. The phenols detected in this study are often associated with allelopathic behavior in Compositae weed species. Allelopathy may be advantageous to *H. tuberosus* cultivation, as it potentially reduces the sensitivity of this species to weed, theoretically allowing a reduction of inputs required for weed control, even in the successive crop, due to the release of phenolic compounds. On the other hand, allelopathic activity of *H. tuberosus* residues may be unfavorable to the sensitive crops cultivated after *H. tuberosus* or planted in an area infested by this species

384. Studies on Allelopathic Physiobiochemical Characteristics of *Solidago canadensis* L. Qiong-xia Guo¹, Li-hua Shen², Zhen Huang³; ¹Fujian Entry-Exit Inspection and Quarantine Bureau, Fuzhou, Fujian, China (Peoples Republic of); ²Key Laboratory of Biopesticide and Chemical Biology, FAFU, Fuzhou, Fujian, China (Peo-

ples Republic of); ³Graduate School of Hainan University, Haikou, China (Peoples Republic of)

The study on the physiobiochemical process and its mechanism of weed allelopathy has now become main issue in the world. For this purpose, wheat as receiver plant were cultured in 1/2 Hoagland nutrient solution which included extracts of allelopathic weed *Solidago canadensis* L. and non-allelopathic weed *Solidago decurrens* Lour., respectively. And then physiobiochemical approach was employed to get first insight into the mechanism of allelopathy in *Solidago canadensis* L.

The results were summarized as follows: the allelopathy of *Solidago canadensis* L. significantly decreased the activities of protective enzymes such as SOD, POD and CAT in wheat, coupling with the increase of free radical contents and serious membrane lipid peroxidation. It was also indicated that root activity in wheat was negatively affected, in turn decreased the uptake of nutrients(N, P, K elements) from the environment. The result also indicated that the extracts of *Solidago canadensis* L. reduced the chlorophyll concentration in wheat, then the weak photosynthesis was the result, consequently leading to decreased dry matter weight of wheat seedlings. The reverse was true in non-allelopathic weed *Solidago decurrens* Lour. The findings suggested that *Solidago canadensis* L. possess a strong allelopathic biological activity and exhibits strong inhibition of wheat.

385. Allelopathic Potential of Sunflower Plant (*Helianthus annuus* L.) on Soil Metals and its Leaves Extracts on Physiology of Wheat (*Triticum aestivum* L.) Seedling. Javed Kamal¹, Asghari Bano¹, Muhammad Riaz¹; ¹Quaid-I-Azam University, Islamabad, Pakistan

The allelopathic potential of cultivar Sunflower variety cv- Hysun 38 (*Helianthus annuus* L.) was studied and its effect on metals and leaf aqueous extract of sunflower at different concentrations were applied to determine their effect on wheat two varieties cv.Margalla 99 and cv.Chakwall 97 seed germination rate and hormonal analysis under laboratory conditions in petridishes were conducted. Commonly observed action of allelochemicals are inhibition of seed germination and abnormalities of seedling development. Catabolism of storage reserves and energy production are most important factors ensuring seed germination, seedling growth and on hormonal analysis of test plants in petridishes . Water extract using different concentrations of sunflower leaves significantly inhibited germination rate and seedling growth and effect on hormones of plants in petridishes as compared to control and in pots its effect on Ec, pH, Mn, Ca, K, and on P.